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## **МУЛЬТИМЕДИЙНЫЕ ТЕХНОЛОГИИ В ПРЕПОДАВАНИИ И ИЗУЧЕНИИ ФИЗИКИ И АСТРОНОМИИ**

**Аннотация:** *Рассматриваются структура, содержание и программная реализация мультимедийных учебных комплексов по атомной физике и астрономии.*

**Ключевые слова:** *атомная физика; астрономия; информационные технологии в образовании*

## **MULTIMEDIA TECHNOLOGIES IN TEACHING AND LEARNING OF PHYSICS AND ASTRONOMY**

**Annotation:** *We present the structure, content and realization of the multimedia training complexes on atomic physics and astronomy.*

**Key words:** *atomic physics; astronomy; information technologies in education*

The formation of new knowledge, abilities, skills and methods of mastering them, taking into account modern information technologies, requires a revision and optimization of traditional methodological tools that ensure high-quality assimilation, control and assessment of knowledge.

At the same time, the classical methodological tools and techniques do not lose their significance at the present stage of development of higher education, but should organically fit into the contour of modern educational technologies. At all stages of the learning process - from the acquisition of knowledge to their assessment and application - the traditional methodology uses new information tools or is supplemented by them. Only by combining the

generally accepted and new technological methods of forming teaching methods is a qualitative transition to a higher level of knowledge assimilation possible.

Modern educational programs and educational and methodological complexes in physics can and should be filled with rich and detailed illustrative and practical laboratory material (images and genuine diagrams of the operation of devices and installations, experimental and calculated spectra, virtual laboratory stands, as well as other results of scientific research and technical developments) and actually turned into multimedia educational and research complexes. An important place in such complexes can be occupied by a direct demonstration of the results of numerical modeling of complex physical phenomena or processes, as well as computer programs of a research orientation. The presence of a significant amount of thematic literature in electronic form (both textbooks and monographs, and original publications of classics and modern researchers in the relevant field of physics) allows you to refer to the necessary literary source using a hyperlink. The main advantages of such complexes are: systematic use of the capabilities of information technology; stylistic unity of material presentation; appropriate use of multimedia; saving time with multiple calls to hypertext materials; the possibility of effective use of educational materials for self-study and distance learning; providing effective feedback, etc.

The discipline "Physics of the atom and atomic phenomena" is an important part of the course of general physics, a basic discipline in the training of specialists in both physical and technical profiles. It is based on modern quantum concepts of the structure of matter. The main goal of the discipline is the formation of fundamental knowledge in the physics of microscopic phenomena at the atomic-molecular level and the ability to apply them to solve practical problems. Strong knowledge of atomic physics is extremely important for the formation of students' adequate ideas about the modern physical picture of the world and a deep understanding of the nature of physical phenomena

occurring at the atomic-molecular level, and the laws to which they obey. This creates a basis for studying the laws of various chemical and biological processes, the principles of functioning of modern technical devices, etc.

The course "Astronomy" is designed to develop and combine astronomical and physical knowledge into a logically harmonious system, to lead students to an understanding of modern ideas about phenomena occurring in the Universe, about the unity of scientific knowledge about the world. Without a doubt, every educated person should have some minimum knowledge of astronomy, and teaching it is inseparable from the task of forming a modern, holistic, scientifically grounded worldview, understanding the place and role of Man in the Universe. It is also significant that at present, using the latest technical developments, astronomy has acquired a significant applied value and is becoming the foundation for the further development of mankind.

The subject area of astronomy as a science covers the most general laws of nature. In view of the importance of astronomical research, 2009 has been declared the International Year of Astronomy by UNESCO. In the 21st century, astrophysicists have repeatedly (in 2002, 2006, 2011 and 2015) become laureates of the Nobel Prize in physics.

In accordance with the above considerations, this multimedia educational complex on atomic physics includes: a course of lectures; a set of multimedia presentations; cycle of laboratory work; tasks for conducting practical exercises; block of control measures; a media library; electronic library.

Electronic multimedia hypertext package of lecture materials is the text of 25 lectures, provided with hyperlinks. The material of the lectures is presented using illustrations in the form of diagrams, graphs and figures, accompanied by examples and assessment data. With the help of the existing hyperlinks, the complex provides viewing of slides and video fragments, multimedia demonstrations of experiments and models of physical phenomena, text material is supported by cited or recommended literature, etc.

Multimedia presentations (16 presentations, about 300 slides) are intended for demonstration during classes or during lectures. They contain a minimal amount of textual information and include most of the photo and video content. Using hyperlinks, presentations are integrated into the lecture course texts.

The laboratory workshop contains 9 experimental (full-scale) works and 6 virtual works based on computer modeling. Each laboratory work is a complex of training and test subsystems that optimize the process of assimilation of knowledge and form the student's professional competence.

The system of control measures is aimed at determining the level of current and final knowledge and skills (including those acquired as a result of independent work), as well as stimulating more active learning activities of students. To carry out control activities, about 20 different options for assignments for conducting control works and about 50 options for assignments for conducting colloquiums have been developed.

The media library is an archive of images (photographs, diagrams, drawings, etc.) and video objects (video recordings, computer animations and simulations) intended for the preparation of presentations and demonstrations during classes. The library has over 200 images and about 20 video objects.

The electronic library includes fragments of teaching aids that are used in hypertext lecture materials; textbooks and monographs necessary for the systematic study of atomic physics and related sections of physics, chemistry and other scientific disciplines; original articles by the classics of physical science, as well as review works devoted to the state of the art in the field of atomic physics.

The multimedia educational complex in astronomy includes: text materials for independent training of students, as well as for preparing teachers for conducting classes (more than 300 pages); a set of multimedia presentations for lecturing (8 blocks of presentations, including about 1230 slides, which

contain more than 700 images and 80 video objects); a collection of tasks and exercises for practical exercises, independent work and control activities (more than 400 tasks); block of control measures, a media library of photo and video materials, computer animation and simulations; electronic library of teaching aids, scientific articles and monographs.

Multimedia educational complexes in atomic physics and astronomy have been introduced into the educational process at the Belarusian State University and are used by third-year students (about 120 people annually) of the Faculty of Physics in the study of relevant academic disciplines. Part of the materials of the complex on atomic physics was published in the form of a textbook [1]. The materials of the astronomy complex were partially included in the textbook [2], which is being prepared for publication in the near future. The complexes are also planned to be supplemented with blocks of computer testing for the current control of knowledge.

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